

Attachment H

COVER SHEET (PAGE 1 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Proposal Title: Abundance and seasonal distribution patterns of juvenile green sturgeon and steelhead trout passing the Red Bluff Diversion Dam, Sacramento River, California.

Applicant Name: U.S. Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office.

Mailing Address: 10950 Tyler Road, Red Bluff, CA 96080

Telephone: (530)527-3043
Fax (530)529-0292

Amount of funding requested:

Task 1 (sturgeon)	\$56,289 / year for FY '99 & '00
Tasks 1 & 2 (sturgeon & trout)	\$168,865 / year for FY '99 & '00

Indicate the Topic for which you are applying (check only one box). Note that this is an important decision: see page 8 of the Proposal Solicitation Package for more information

- | | |
|---|--|
| <input type="checkbox"/> Fish Passage Assessment | <input type="checkbox"/> Fish Passage Improvements |
| <input type="checkbox"/> Floodplain and Habitat Restoration | <input type="checkbox"/> Gravel Restoration |
| <input type="checkbox"/> Fish harvest | <input checked="" type="checkbox"/> Species Life History Studies |
| <input type="checkbox"/> Watershed Planning/Implementation | <input type="checkbox"/> Education |
| <input type="checkbox"/> Fish Screen Evaluations - Alternatives and Biological Priorities | |

Indicate the geographic area of your proposal (check only one box):

- | | |
|---|---|
| <input checked="" type="checkbox"/> Sacramento River Mainstem | <input type="checkbox"/> Sacramento Tributary: _____ |
| <input type="checkbox"/> Delta | <input type="checkbox"/> East Side Delta Tributary: _____ |
| <input type="checkbox"/> Suisun Marsh and Bay | <input type="checkbox"/> San Joaquin Tributary: _____ |
| <input type="checkbox"/> San Joaquin River Mainstem | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> landscape (entire Bay-delta watershed) | <input type="checkbox"/> North Bay: _____ |

Indicate the primary species which the proposal addresses (check no more than two boxes):

- | | |
|--|---|
| <input type="checkbox"/> San Joaquin and East-side Delta tributaries fall-run chinook salmon | <input type="checkbox"/> Spring-run chinook salmon |
| <input type="checkbox"/> Winter-run chinook salmon | <input type="checkbox"/> Fall-run chinook salmon |
| <input type="checkbox"/> Late-fall run chinook salmon | <input type="checkbox"/> Longfin smelt |
| <input type="checkbox"/> Delta smelt | <input checked="" type="checkbox"/> Steelhead trout |
| <input type="checkbox"/> Splittail | <input type="checkbox"/> Striped bass |
| <input checked="" type="checkbox"/> Green sturgeon | |
| <input type="checkbox"/> Migratory birds | |

COVER SHEET (PAGE 2 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Indicate the type of applicant (check only one box):

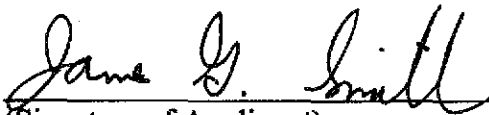
- | | |
|--|--|
| <input type="checkbox"/> State agency | <input checked="" type="checkbox"/> Federal agency |
| <input type="checkbox"/> Public/Non-profit joint venture | <input type="checkbox"/> Non-profit |
| <input type="checkbox"/> Local government/district | <input type="checkbox"/> Private party |
| <input type="checkbox"/> University | <input type="checkbox"/> Other: _____ |

Indicate the type of project (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> Planning | <input type="checkbox"/> Implementation |
| <input checked="" type="checkbox"/> Monitoring | <input type="checkbox"/> Education |
| <input type="checkbox"/> Research | |

By signing below, the applicant declares the following:

- (1) the truthfulness of all representations in their proposal;
- (2) the individual signing the form is entitled to submit the application on behalf of the applicant (if applicant is an entity or organization); and
- (3) the person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section II.K) and waives and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

 _____

(Signature of Applicant)

II.

Executive Summary

a. Project title.—Abundance and seasonal distribution patterns of green sturgeon and steelhead trout passing the Red Bluff Diversion Dam, Sacramento River, California.

Applicant name.—U. S. Fish and Wildlife Service, Northern Central Valley Fish and Wildlife Office, 10950 Tyler Road, Red Bluff, California 96080. Phone: (530)527-3043, Fax: (530)529-0292, email: jim_smith@mail.fws.gov.

b. Project Description.—The goal of this project is to gain a better understanding of life history characteristics of anadromous fish species in the Sacramento River Ecological Zone that will aid in the development and implementation of restoration and management actions used to achieve CALFED goals. Specific objectives are to provide estimates of abundance and outmigration timing of downstream migrating juvenile green sturgeon *Acipenser medirostris* (Task 1; sturgeon) and steelhead trout *Oncorhynchus mykiss* (Task 2; trout) near the Red Bluff Diversion Dam (RBDD).

Primary biological/ecological objectives.—The primary benefits of this project are more precise indices of production and outmigration timing of sturgeon and trout spawned above RBDD. Data from Task 1 (sturgeon) will be integrated with a CALFED proposal entitled "Spawning areas of green sturgeon *Acipenser medirostris* in the upper Sacramento River"; and, will clearly define where and when sturgeon are spawning, and when fry are emerging and emigrating out of the Sacramento River Ecological Zone. Furthermore, Tasks 1 (sturgeon) and 2 (trout) will estimate year-class strength and elucidate possible affects Red Bluff Diversion Dam (RBDD) might have on sturgeon and trout populations in the main-stem Sacramento River.

These indices can be used for inter-year comparison of trends which provide indicators of the success of restoration actions. The data from RBDD sampling is used for a variety of management purposes from indicators of year-class strength, genetic sampling, and triggers for remedial measures pertaining to flow, temperature, and entrainment. It also provides the clearest picture available for sturgeon and trout populations, contributing extensively to our knowledge of the life history of these fishes. Since July 1994 through December 1997, over 300,000 fish consisting of 37 different species have been captured at RBDD; including green sturgeon, steelhead trout, chinook salmon *Oncorhynchus tshawytscha*, species of concern Sacramento splittail *Pogonichthys macrolepidotus*, and pink salmon *Oncorhynchus gorbuscha*.

c. Approach.—Absolute abundance indices for sturgeon migrants passing RBDD will be estimated by extrapolating catch-per-volume-sampled to river discharge passing RBDD (Johnson and Martin 1997), and for trout by the rotary-screw-trap efficiency method (Thedinga et al. 1994, Keenan et al. 1994). Indices for total fish passing the sampling transect will be calculated daily from catches in traps. Relative abundance indices for sturgeon and trout will be calculated from catch-per-water-volume-sampled or catch-per-cone-rotation. Absolute and relative abundance indices will be used to evaluate seasonal and temporal patterns of abundance. Linear regression models will be used to evaluate environmental ques (e.g., water temperature, water turbidity, and river flows) affecting rates and timing of outmigration. An appearance rating system will be used to differentiate between smolt-sized andromous steelhead and resident rainbow trout. Task 1 (sturgeon) will focus on young-of-year green sturgeon; Task 2 (trout) will focus on young-of-year and yearling steelhead trout.

Tasks.—Juvenile monitoring has been funded by Reclamation since 1994 as part of the evaluation of the Red Bluff Research Pumping Plant (RPP). This sampling is conducted four days per week, 24-hours per day. With additional funding for Task 1 (sturgeon), sampling would be expanded an additional three days per week (7 days total) from May through September to completely monitor green sturgeon outmigration during FY '99 and '00. Task 2 (trout) would

include funding for increasing from the current 4 day to 7-day sampling throughout the year for juvenile trout monitoring during FY '99 and '00.

Schedule.—**Task 1 (sturgeon)** field work will be seasonal between the months of May and August, and **Task 2 (trout)** would include sampling throughout the year for FY '99 and '00. A draft report suitable for submission to Transactions of the American Fisheries Society will be completed by the end of the calendar year 1999 and 2000. Primary project review will occur within the Service, Reclamation, IEP, and California Fish and Game.

d. Justification for Project and Funding by CALFED.—The RBDD site is below the main-stem spawning areas for many priority species including green sturgeon, steelhead trout, winter chinook, main-stem spring chinook, and late-fall chinook. Additionally, rotary-screw-trap sampling has documented young-of-year pink salmon and adult splittail. Sampling at this site would benefit numerous programs involving the restoration of many of these fishes. Juvenile sampling at RBDD and sampling 7 days per week is consistent with recommendation of other ecosystem restoration programs, such as: Central Valley Project Improvement Act (CVPIA), Red Bluff Diversion Dam CVPIA (3406 [b] 10) actions and planning process, Anadromous Fisheries Restoration Program (AFRP), Comprehensive Assessment and Monitoring Program (CAMP) and Red Bluff Research Pumping Plant Evaluations.

e. Budget Costs.—Annual project costs for an expansion of the existing Reclamation evaluations of the Research Pumping Plant at RBDD for **Task 1 (sturgeon)** is \$56,289 and \$168,865 for **Tasks 1 & 2 (sturgeon & trout)**. This project would continue through FY '00 or as long as data is needed by managers and researchers working on restoration projects in the basin.

f. Applicant Qualifications.—The Northern Central Valley Fish and Wildlife Office (NCVFWO) was established in 1978 as part of the U.S. Fish and Wildlife Service's (Service) responsibility to facilitate restoration of Pacific salmonids. The staff consists of 30 biologists and support personnel which have working experience in the upper Sacramento River.

g. Monitoring and Data Evaluation.—This is a monitoring project whose data will be used in a variety of management and research efforts. Information from **Task 1 (sturgeon)** will be integrated with another CALFED proposal entitled "Spawning areas of green sturgeon *Acipenser medirostris* in the upper Sacramento River". Research from both of these projects will provide much-needed information on green sturgeon life history in the Sacramento River Ecological Zone. Data from **Task 2 (trout)** will be used to address the large deficiency in information regarding steelhead life history patterns and other aspects of steelhead biology in the upper Sacramento River.

Data evaluation and peer review are critical to the success of this project. Primary project review will occur within the Service, Reclamation, IEP and California Department of Fish and Game. This data is integrated into the RPP evaluation and IEP programs.

h. Local Support/Coordination with other Programs/Compatibility with CALFED

Objectives.—Sampling at the RBDD benefits numerous restoration programs by contributing and integrating data into the RPP, IEP, CAMP and AFRP programs. RBDD sampling is supported by the Salmon Project Work Team of the IEP. Main-stem juvenile monitoring at RBDD has been identified in all current restoration planning documents: *Upper Sacramento River Fisheries and Riparian Habitat Management Plan*, *Central Valley Salmon and Steelhead Restoration and Enhancement Plan*, *Restoring Central Valley Streams: A Plan for Action*, and *Steelhead Restoration and Management Plan for California*, and *Working Paper on restoration needs: habitat restoration actions to double natural production of anadromous fish in the Central Valley of California*.

**ABUNDANCE AND SEASONAL, SPATIAL AND DIEL DISTRIBUTION
PATTERNS OF JUVENILE SALMONIDS PASSING THE RED BLUFF
DIVERSION DAM, SACRAMENTO RIVER CALIFORNIA**

U.S. Fish and Wildlife Service
Northern Central Valley Fish and Wildlife Office

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Federal Agency—Tax Exempt

Participants/Collaborators—U. S. Bureau of Reclamation

Life History Studies

June 1998



IV.

Project Description

a. Project Description and Approach.—The goal of this project is to gain a better understanding of specific life history characteristics of anadromous fish in the Sacramento River Ecological Zone that will aid in the development and implementation of restoration and management actions used to achieve CALFED goals. The objectives of this project is to provide estimates of abundance and outmigration timing of downstream migrating juvenile green sturgeon (**Task 1 (sturgeon)**) and steelhead trout (**Task 2 (trout)**) near the Red Bluff Diversion Dam (RBDD). Specific objectives are to estimate 1) abundance of juvenile outmigrants passing RBDD and 2) seasonal and spatial distribution patterns. These objectives are being addressed in a multiyear study program funded by the U. S. Bureau of Reclamation (Reclamation) which began in 1994 as part of the Research Pumping Plant (RPP) evaluation. Juvenile monitoring at RBDD would benefit from CALFED support to expand the program in FY '99 and '00 from four to seven days per week.

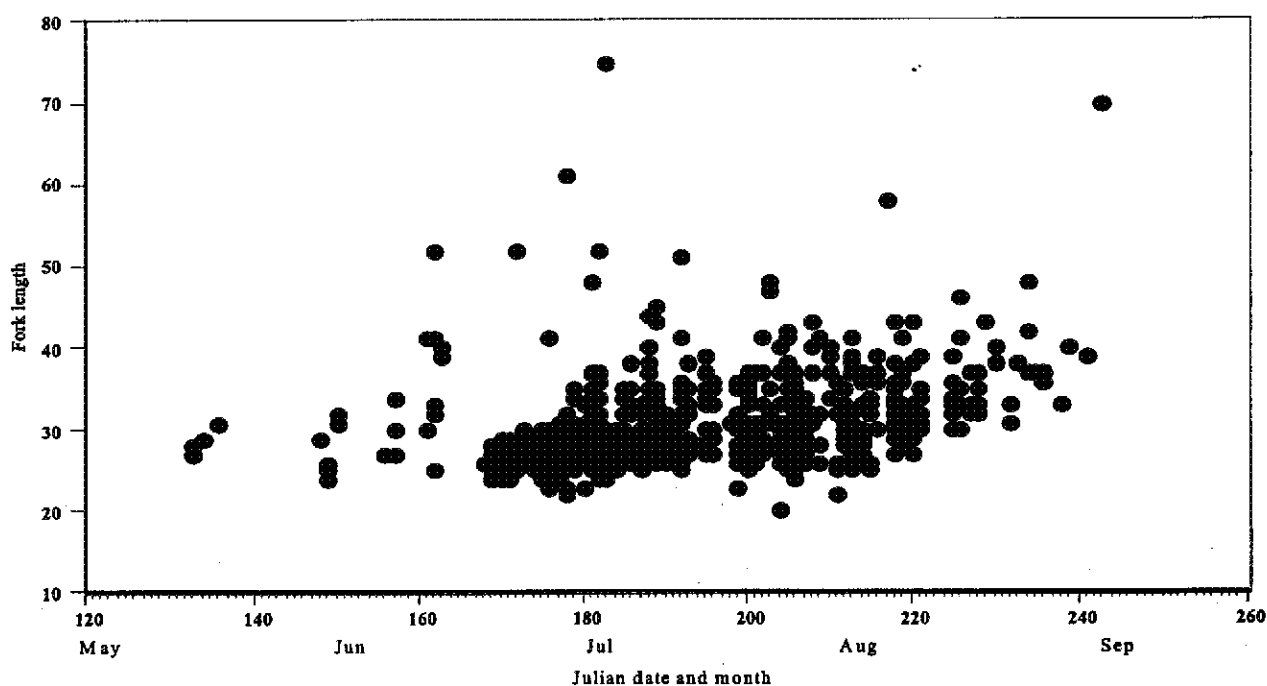


Figure 1.--Length distributions of juvenile sturgeon captured in 1994, 1995, 1996 and 1997 in rotary screw traps at Red Bluff Diversion Dam. Subsamples of sturgeon captured were grown out by Patrick Foley (U.C. Davis) and all were identified as green sturgeon

Juvenile green sturgeon have been observed at Red Bluff between the months May and August, and funding would be required for these months to completely monitor juvenile sturgeon migrating past RBDD (Figure 1; **Task 1 (sturgeon)**).

Juvenile Steelhead trout have been observed at RBDD throughout the year (Figure 2; **Task 2 (trout)**). Two distinct asynchronous age-0 cohorts emigrated past RBDD between October 1995 and November 1996; the first cohort occurring between weeks 12 and 38, and the second between weeks 30 and 44. Two emigration periods were also observed at RBDD for smolt-sized trout; one of which

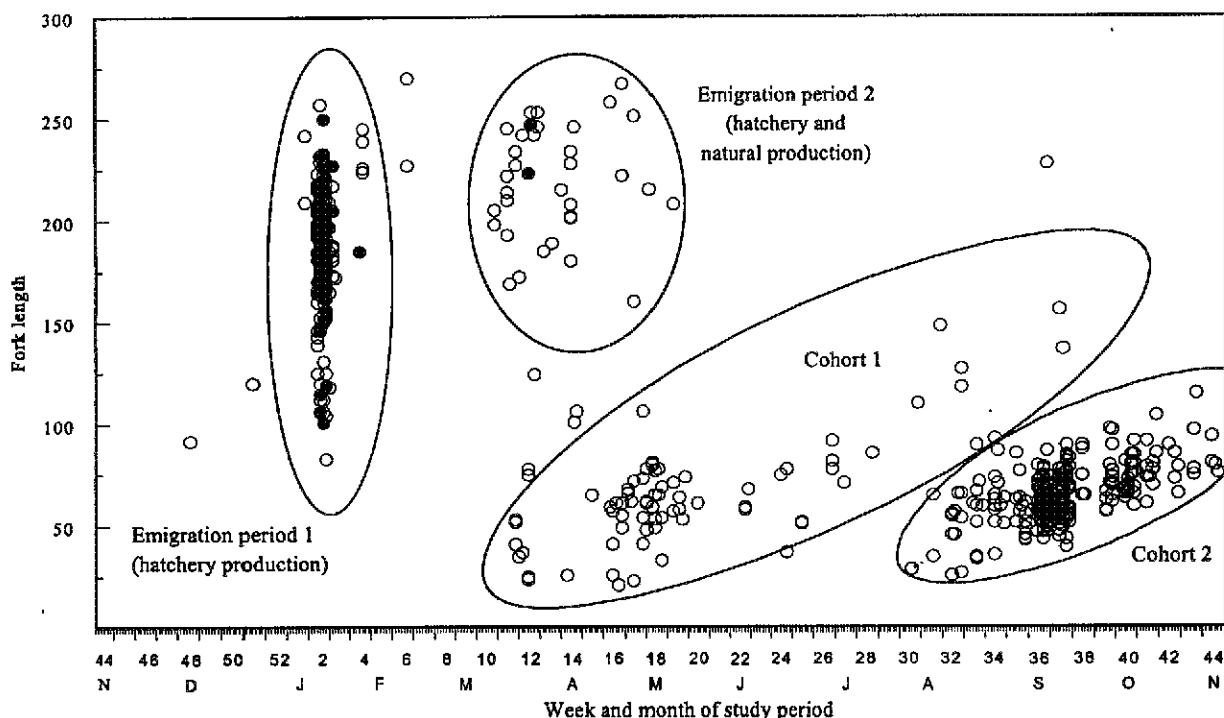


Figure 2.--Daily length distributions for *Oncorhynchus mykiss* captured in rotary-screw traps at Red Bluff Diversion Dam between 29 October 1995 to 2 November 1996. Open circles symbolize lengths of non-adclipped trout captured and solid circles symbolize fork lengths of Coleman National Fish Hatchery adipose fin-clipped fish.

was a one-half-million hatchery release in January, including 400,000 unmarked fish. Most hatchery-produced fish migrated past RBDD immediately (Emigration period 1), yet some resided in the upper river for extended periods of time (Emigration period 2). Nevertheless, some *O. mykiss* captured during Emigration period 2 were likely naturally-produced yearling steelhead trout. Substantial trout production occurs in the upper Sacramento River; however, production attributable to anadromous steelhead, and resident main-stem and tributary-spawning rainbow trout is largely unknown. Monitoring throughout the year will be needed to establish baseline information for juvenile and smolt-sized steelhead stocks emigrating out of the upper Sacramento River.

Sampling consists of up to four, eight-foot diameter rotary-screw traps deployed immediately downstream of the RBDD. The traps are deployed laterally across the river to provide coverage in the river thalweg and edges. Traps will be fished 24-hours per day, seven days a week.

b. Proposed Scope of Work.—Absolute abundance indices for sturgeon migrants passing RBDD will be estimated by extrapolating catch-per-volume-sampled to river discharge passing RBDD (Johnson and Martin 1997) and for trout by the rotary-screw-trap efficiency method (Thedinga et al. 1994, Keenan et al. 1994). Indices for total fish passing the sampling transect will be calculated daily and weekly from catches in traps. Relative abundance of juvenile salmonids will be calculated from catch-per-water-volume-sampled or catch-per-cone-rotation.

Relative abundance for steelhead trout and sturgeon will be analyzed by week, and these indices will be used to describe seasonal patterns of abundance. Absolute abundance indices will be used to monitor inter-year trends of juvenile production in an effort to evaluate restoration activities in the Sacramento River Ecological Zone. Spatial distribution patterns will be determined by comparing relative abundance of trout and sturgeon between traps.

c. Location and/or Geographic Boundaries of Project.—The RBDD is located in the Sacramento River at river mile 243 about 2 miles southeast of the city of Red Bluff, Tehama County. It was completed in 1964, and began operation in 1966. The purpose of the dam is to divert water into the Tehama-Colusa and Corning Canal system, for agriculture and wildlife refuges. The dam consists of eleven moveable gates which can be raised or lowered to impound and divert river flows into the canal. Sampling at RBDD would effectively monitor sturgeon and trout production in the Keswick to RBDD ecological unit.

d. Expected Benefits.—This project will document trends in juvenile sturgeon and trout abundance which will contribute extensively to our knowledge of these species life history, and can be used to evaluate the numerous restoration actions that will, and/or have occurred within the Keswick Dam to RBDD ecological unit. This project will complement the CALFED proposal entitled "Spawning areas of green sturgeon *Acipenser medirostris* in the upper Sacramento River". Stressors in the upper Sacramento River are thought to be water temperature, fish passage (adult and juvenile), loss of spawning habitat and riparian forests. These stressors effect sturgeon and trout and other 1st-tier priority species including winter, spring and late-fall chinook. Restoration actions which would be supported by main-stem juvenile monitoring at RBDD have been identified in all current restoration planning documents (Resources Agency 1989, Reynolds et al. 1990, Reynolds et al. 1993, Anadromous Fish Restoration Plan (AFRP; U. S. Fish and Wildlife Service 1995, and McEwan and Jackson 1996, Comprehensive Monitoring and Assessment Program {CAMP; U. S. Fish and Wildlife Service 1996}). The RBDD is an excellent sampling location below the spawning areas of many of the main-stem anadromous fish species. Since July 1994 through December 1997, over 300,000 fish consisting of 37 different species have been captured at RBDD; including green sturgeon, Steelhead trout, endangered winter chinook salmon, priority species late-fall and spring chinook. Recently, adult splittail have been captured in rotary-screw traps marking their upper distribution, and juvenile pink salmon, documenting spawning success in the upper river for this species.

The primary benefits of this project are more precise indices of juvenile sturgeon and trout production, and timing of emergence and outmigration. Secondly, impacts of the RBDD on main-stem sturgeon and trout populations will be investigated. This information can be used to formulate trends which provide indicators of the success of restoration actions. Currently, data from RBDD sampling is used for a variety of management purposes from indicators of year-class strength, genetic sampling, and triggers for remedial measures pertaining to flow, temperature and entrainment. Secondary benefits include a better understanding of main-stem fish populations; including 1st tier primary species (winter, spring and late-fall chinook), 2nd tier primary species (splittail) and secondary species (fall chinook).

The RBDD juvenile monitoring project is needed to expand and adapt new knowledge of sturgeon and trout life history to management needs of the Sacramento River. The project provides real-time data on migrational movements of green sturgeon, steelhead trout and chinook salmon out of the upper Sacramento River, and provides indices of abundance. These data can be used to evaluate the effectiveness of restoration efforts on priority species designed to address stressors. The following paragraphs provide background on upper river stressors which have been identified for restoration actions and could be assessed by juvenile monitoring at RBDD.

Spawning Gravel.—Loss of gravel recruitment is believed to be a major contributing factor to declining anadromous fish stocks in the upper Sacramento River below Keswick Dam (Upper Sacramento River Fisheries and Riparian Habitat Advisory Council 1989 {Plan}). Spawning gravel

depletion has been most severe in the stretch of the Sacramento River from Keswick Dam (River Mile {RM} 302.0) to the mouth of Cottonwood Creek (RM 273.5). Historically, gravel in this river reach had been recruited from above Shasta Dam or by bank erosion. Because these sources of gravel are no longer available, the Plan recommended placement of about one-million yd³ of spawning gravel in this reach of river. Subsequent to these recommendations, the California Department of Water Resources (CDWR) has added approximately 100,240 yd³ of spawning gravel to the upper Sacramento River. Indices of juvenile abundance developed from the RBDD screw-trap data would be a valuable indicator of increased spawning success.

Fish Passage.—Fish ladders at RBDD were not designed for and are not utilized by migrating adult sturgeon, blocking upstream spawning habitats and causing increased spawning downstream in waters perhaps too warm for successful egg incubation. Blockage and delays at the dam may also produce elevated stress conditions in adult trout. Indices of juvenile abundance developed from screw-trap data would be a valuable indicator of increased passage and spawning success above RBDD.

Water Temperature.—Water temperature in the Sacramento River has been identified as a major limiting factor to salmon and steelhead restoration in the upper Sacramento River (NMFS 1993), and may affect sturgeon restoration as well. Green sturgeon are believed to spawn in temperatures ranging from 8 to 14°C (Moyle et al. 1995). The Shasta-Trinity Unit of the Central Valley Project has the ability to control water temperature in 60 miles of the Sacramento River downstream of Keswick Dam during most years which would provide adequate conditions for all life stages of sturgeon and trout. The beneficial effects of temperature control on sturgeon spawning and egg incubation has not been quantified; however, indices of juvenile abundance developed from the RBDD screw-trap data would be a valuable indicator of successful spawning as a function of temperature. This would be of particular interest in relation to the effectiveness of the temperature control device and cold-water releases at Shasta Dam.

Riparian Forests.—Many factors have resulted in considerable reduction in the amount of riparian habitat along the Sacramento River. Agricultural conversion is the principal reason for the decline. Completion of Shasta Dam as part of the Central Valley Project fostered further conversions of habitat to agriculture as decreasing flood risks allowed the planting of orchards and row crops in the historical floodplain. Bank protection also fostered conversion of forests by reducing bank erosion and meandering. The Central Valley Project dramatically altered the river's natural flow regime and sediment transport characteristics, changing patterns of forest regeneration. Other current and historical factors contributing to the degradation of the riparian system include timber and fuel harvesting, and urban and residential development.

For most of the length of the river, many of these factors currently preclude the reestablishment of an active meander zone. North of Cottonwood Creek, for example, lack of flooding has disrupted the historical pattern of vegetative succession, resulting in a reduction in early successional stages of riparian forests. While the river is not meandering in these reaches, valuable habitat remains, providing benefits to salmon, trout, sturgeon, and other wildlife species. The reestablishment of such a system along the Sacramento River would have several positive impacts on sturgeon and other fish populations. These include: 1) maintaining channel configurations suitable for creating spawning riffles; 2) supplying gravel from eroding banks for the creation of spawning riffles; 3) supplying woody-debris which provides habitat for juvenile fish and a source of organic material for aquatic invertebrates; 4) supplying a renewable source of shaded riverine aquatic habitat; 5) supplying terrestrial invertebrate food for juvenile fish, and 6) moderating the temperature regime

of the river, and near-shore and backwater areas.

Indices of juvenile abundance developed from the RBDD screw-trap data is a valuable indicator of successful spawning, egg incubation, and rearing. These indices would hence provide evidence of the positive effects of CALFED restoration actions.

e. Background and Biological /Technical Justification.—

Table 1(a).—Implementation objectives, targets and programmatic actions addressed by Task 1 (sturgeon).

Heading	Subheading	Target #	Action #	Page #	Reference #
Sacramento River Ecological Zone - Keswick to RBDD Ecological Unit (ERPP vol. 2)					
Reducing or eliminating stressors	Water diversions	1	1C	151	1
Reducing or eliminating stressors	Dams, reservoirs, weirs, and other structures	1		152	2
White sturgeon and green sturgeon	Green sturgeon	1	1A	159	3
Species and species group visions (ERPP vol. 1)					
White and green sturgeon	Implementation objective	NA ^a	NA ^a	148	4
Visions for reducing or eliminating stressors (ERPP vol. 1)					
Water diversions	Implementation objective	NA ^a	NA ^a	276	5

^a NA = Not applicable

Green sturgeon spawn in the main-stem Sacramento River between late February and late July (Moyle et al. 1995). Although little is known about green sturgeon spawning requirements, it is thought that spawning activity occurs in temperatures between 8-14°C in large cobble substrate (Moyle et al. 1995). Most of the available spawning habitat fitting these requirements during the latter part of their spawning migration (May through July) occurs upstream from RBDD during periods of gate closure, blocking further upstream migrations (Kurt Brown, personal communication, USFWS, Red Bluff). Since the start of this project, however, newly-emerged green sturgeon have been routinely captured in rotary-screw traps below RBDD after gate closure (May through August, Figure 1). Magnitude and timing of migrations are needed to allow managers to operationally modify gate operations to minimize entrainment and maximize survival of juvenile sturgeon passing RBDD (Table 1(a), Reference #'s 1 and 5). Secondly, information obtained from this project and that from the CALFED project proposal entitled "Spawning areas of green sturgeon *Acipenser medirostris* in the upper Sacramento River" will locate critical spawning habitat and timing in the Sacramento River Ecological Zone, and elucidate impacts on sturgeon populations blocked by RBDD during gates-in operation by identify critical life-history periods. This information will be useful for managers making long-term decisions about Red Bluff passage issues (Table 1(a),

Reference # 2). Furthermore, this project would support the completion of and be included in the final evaluation of the Red Bluff Research Pumping Plant (Table 1(a), Reference # 5).

Green sturgeon populations are expected to benefit and respond to a variety of programmatic actions implemented to "increase and improve stream flows, natural sediment supply, stream channel meander, and the area and distribution of riverine aquatic habitat". Information on sturgeon production in the upper River will be needed to evaluate programmatic actions implemented to restore sturgeon distributions and abundances to levels that ensure their continued existence (Table 1(a), Reference #'s 3 and 4).

Table 1(b).—Implementation objectives, targets and programmatic actions addressed by **Task 2 (trout)**.

Heading	Subheading	Target #	Action #	Page #	Reference #
Sacramento River Ecological Zone - Keswick to RBDD Ecological Unit (ERPP vol. 2)					
Reducing or eliminating stressors	Water diversions	1	1C	151	1
Reducing or eliminating stressors	Dams, reservoirs, weirs, and other structures	1		152	2
Steelhead trout	Implementation objective			163	3
Species and species group visions (ERPP vol. 1)					
Steelhead trout	Implementation objective	NA ^a	NA ^a	160	4
Visions for reducing or eliminating stressors (ERPP vol. 1)					
Water diversions	Implementation objective	NA ^a	NA ^a	276	5

^a NA = Not applicable

Many of the implementation objectives discussed for **Task 1 (sturgeon)** also pertain to **Task 2 (trout)**. These topics include: (1) obtaining the information needed to allow resource managers to operationally modifying gate operations to minimize entrainment and maximize survival of juvenile steelhead trout passing RBDD (Table 1(b), Reference #1), (2) elucidate impacts on steelhead populations blocked or delayed by RBDD during gates-in operation and identify critical life-history periods that may be useful when making long-term decisions for Red Bluff passage issues (Table 1(b), Reference # 2), (3) providing CALFED administrators with supporting evidence of the affects of restoration actions in the Sacramento River Ecological Zone (Table 1(b), Reference # 4), and (4) support by CALFED for the completion of research activities at the Red Bluff Research Pumping Plant (Table 1(b), Reference # 5)

A paucity of information currently exists for steelhead trout populations in the Sacramento River Ecological Zone. CALFED needs to support additional research to address this large deficiency in information regarding steelhead life history patterns and other aspects of steelhead biology before full recovery of this species can be expected. **Task 2 (trout)** monitoring will address informational

needs on steelhead trout production in the Keswick to RBDD ecological unit (Table 1(b), Reference # 3).

Technical justification.—Rotary-screw traps have provided estimates of abundance and outmigration timing of downstream migrating juvenile green sturgeon, steelhead trout, chinook salmon and other fish species near the RBDD since July 1994. Since that time, up to four rotary-screw traps have sampled juvenile sturgeon and other fishes almost continuously. Sampling has occurred in flows up to 65,000 ft³/s in the main river thalweg and shoreline areas.

Juvenile monitoring has been an activity of the U. S. Fish and Wildlife Service in Red Bluff since 1981 and has made significant contribution to our understanding of the life history, rearing, and emigration patterns of sturgeon, trout, and salmon in the upper Sacramento River from Keswick Dam to Hamilton City. Trapping at RBDD has amassed a considerable baseline of juvenile outmigrant data which stretches from 1983 to the present and includes louver entrainment monitoring which occurred under all river-flow conditions.

For 20 years the RBDD gates remained closed year-round, until winter of 1986 when the gates were raised during the nonirrigating season to improve upstream fish passage. During periods when gates are raised at RBDD there is still need for irrigation water. To supply this water, the Reclamation is investigating the use of pumps with the RPP. The Reclamation plans to evaluate the effects of these pumps on fish entrained into the system. In order to understand the vulnerability of juvenile sturgeon and salmonids for potential entrainment into the pumps, information on the population of fish in the river moving downstream past RBDD is required. To date the RPP project has completed one progress report and 16 quarterly reports on monitoring activities (Johnson and Martin 1997). A second report will be completed summer of 1998. Additionally, biweekly reports are provided to managers and researchers which include numbers of salmonids sampled by race and location. This information is valuable and probably the best available information on juvenile winter chinook production in the upper Sacramento River. Managers and researchers have come to depend on monitoring data from RBDD to assess indices of abundance for juvenile winter chinook. This information is valuable for evaluating actions related to stressors in the upper Sacramento River. RBDD sampling has also provided tissues of winter chinook outmigrants to researchers developing tools to identify winter chinook in the confounding environments of the Sacramento-San Joaquin Delta. Without sampling at RBDD, managers will base decisions on less and more tenuous data.

The RPP rotary-screw-trap sampling has been funded by the Reclamation since 1994 as part of the evaluation of the Research Pumping Plant. Generally this sampling is conducted four days per week, 24-hours per day. With additional funding, sampling could be expanded an additional three days per week during juvenile sturgeon downstream migrations between the months of May and August in FY '99 and '00. Other sampling alternatives are considered inferior to rotary-screw traps in this application (USFWS 1996). Rotary-screw traps will be an integral sampling tool of CAMP, IEP and RPP programs.

f. Monitoring and Data Evaluation.—This is a life-history and monitoring project whose data will be used in a variety of management and research efforts. Data evaluation and peer review are critical to the success of this project. Primary project review will occur within the Service, Reclamation, IEP and local California Department of Fish and Game. This data is integrated into the RPP evaluation and IEP programs.

The program is currently coordinated with sampling at Balls Ferry, Glen Colusa Irrigation District, Knights landing and other IEP projects. Quarterly reports are currently reviewed by an Interagency Technical Team which consists of Reclamation, NMFS, CDFG, Service and stakeholder

review.

g. Implementability.—The RBDD monitoring project complies with all laws and regulations. It is included in the Service's Endangered Species section 10 permit for the directed take of winter chinook and the CDFG-MOU on Service sampling in the Sacramento River and its tributaries.

References

- Brown, L. R. and P. B. Moyle. 1981. The impact of squawfish on salmonid populations: A review. *North American Journal of Fisheries Management*. 1:104-111.
- Johnson, R. R. and C. D. Martin. 1997. Abundance and seasonal, spatial and diel distribution patterns of juvenile salmonids passing the Red Bluff Diversion Dam, Sacramento River, July 1994 - June 1995. Red Bluff Research Pumping Plant Report Series, Volume 2. U. S. Fish and Wildlife Service, Red Bluff, CA.
- Keenen, J. G., S. J. Wisniewski, N. H. Ringler, and H. M. Hawkins. 1994. Application and modification of an auger trap to quantify emigrating fishes in Lake Ontario tributaries. *North American Journal of Fisheries Management* 14:828-836.
- McEwan, D. and T. A. Jackson. 1996. Steelhead Restoration and Management Plan for California. The Resource Agency, State of California, Department of Fish and Game. 234 pp.
- Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Yikramanayake. 1995. Fish species of special concern in California. 2nd edition. Department of Fish and Game, Inland Fisheries Division, Rancho Cordova.
- NMFS. 1993. Biological Opinion for the operation of the Federal Central Valley Project and the California State Water Project. National Marine Fisheries Service.
- Resources Agency. 1989. Upper Sacramento River Fisheries and Riparian Habitat Management Plan. Prepared for the Resources Agency by an Advisory Council established by SB 1086, authored by Senator Jim Nielsen. 158 pp.
- Reynolds, F. L., T. J. Mills, and J. Schuler. 1990. Central Valley Salmon and Steelhead Restoration and Enhancement Plan. California Department of Fish and Game, Inland Fisheries Division. 115 pp.
- Reynolds, F. L., T. J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley Streams: A Plan for Action. California Department of Fish and Game, Inland Fisheries Division.
- Thedinga, J. F., M. L. Murphy, S. W. Johnson, J. M. Lorenz, and K. V. Koski. 1994. Determination of salmonid smolt yield with rotary-screw traps in the Situk River, Alaska, to predict effects of glacial flooding. *North American Journal of Fisheries Management*. 14:837-851.
- U. S. Fish and Wildlife Service. 1995. Working Paper on restoration needs: habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume 1, 2 and 3. May 9, 1995. Prepared for the U. S. Fish and Wildlife Service under the direction of the Anadromous Fish Restoration Program Core Group. Stockton, California.
- U. S. Fish and Wildlife Service. 1996. The Comprehensive Monitoring Plan to Evaluate the Relative Effectiveness of CVPIA Actions in Restoring Anadromous Fish Production. Technical Memorandum 2. Administrative Draft. Sacramento, California.
- Upper Sacramento River Fisheries and Riparian Habitat Advisory Council. 1989. Upper Sacramento River fisheries and riparian habitat management plan. State of California Resources Agency. 158 p.

V.

Budget Costs

a. Budget Costs.—Table 2 has the annual project costs for the expansion to seven days/week of the existing Reclamation evaluation of the Research Pumping Plant at RBDD. Funding is being requested through FY '00. This project uses existing equipment, such as boats, trucks and traps.

Table 2.—Annual budget to expand RBDD sampling from four to seven days per week for **Task 1 (sturgeon)** and **Tasks 1 (sturgeon) & 2 (trout)**.

Project Phase and Task	Direct Labor Hours	Direct Salary and Benefits	Overhead Labor (General, Administration and fee)	Service Contracts	Material and Acquisition Contracts	Misc. and other Direct Costs	Total Costs
3 da/wk; 4 months Task 1 (sturgeon)	2,600	\$42,040	\$9,249	\$0	\$0	\$5,000	\$56,289
3 da/wk; 12 months Tasks 1 & 2 (sturgeon & trout)	7,800	\$126,119	\$27,746	\$0	\$0	\$15,000	\$168,865

CALFED funding is needed to supplement current funding from the Reclamation. Funding could potentially be shared with AFRP programs, if and when that funding becomes available.

b. Schedule Milestones.—Task 1 (sturgeon) field work will be seasonal between the months of May and August, and **Tasks 1 & 2 (sturgeon & trout)** would include sampling throughout the year. Funding is being requested for FY '99 and '00. A draft report suitable for submission to Transactions of the American Fisheries Society will be completed by the end of the calendar year 1999 and 2000. Primary project review will occur within the Service, Reclamation, IEP, and California Fish and Game.

c. Third Party Impacts.—None.

VI.

Applicant Qualifications

Northern Central Valley Fish and Wildlife Office (NCVFWO) was established in 1978 as part of the U.S. Fish and Wildlife Service's (Service) responsibility to facilitate restoration of Pacific salmonids. The construction and operation of dams and water diversion projects and the subsequent degradation and loss of habitat have been the primary contributors to the decline in all anadromous salmonid stocks in the upper Sacramento River. Specific goals of the NCVFWO are to: 1) Stabilize or increase the runs of anadromous salmonids in the Sacramento River system, 2) Improve the effectiveness of federal fish propagation facilities in California and Nevada, 3) Protect and restore

the productivity of natural habitats in the Sacramento River system, and 4) Continue development of information and strategies for protecting the natural habitats of the Sacramento River system as migration routes, spawning areas, and nursery areas for anadromous salmonids. The staff consists of 30 biologists and support personnel which have experience or are currently working in the upper Sacramento River.

Project Personnel and Qualifications

James G. Smith.—Mr. Smith's position is with the U.S. Fish and Wildlife Service as Project Leader at the Northern Central Valley Fish and Wildlife Office at Red Bluff where he is responsible for the management of a 30 person office. Mr Smith received a B. S. degree with major in Fishery Biology from Humboldt State University in 1975 and did post-graduate studies at the same from 1976-79. He has work as a professional biologist for 19 years in Oregon, Washington and California. For the past fifteen years he has been personally involved with numerous fishery studies involving salmon including fish passage investigations at RBDD, monitoring downstream migrations of juvenile salmonids, hatchery evaluation efforts at Coleman NFH, and salmon spawning gravel restoration evaluation activities. The office has responsibilities that include identifying and defining factors affecting the abundance and survival of anadromous salmonids produced in the Sacramento River Basin, California. Mr. Smith works on a daily basis with numerous federal, state, and private entities in developing actions and programs for restoring, conserving, and enhancing anadromous salmonids in the upper Sacramento River.

Richard R. Johnson.—Mr. Johnson is a 1976 graduate from Humboldt State University (B.S.), with major in Fishery Biology. He did post-graduate work at the University of Alaska, Fairbanks from 1990-91. He has been a professional fishery biologist for 20 years. Mr. Johnson has experience as a commercial salmon fisherman, and in commercial and federal hatcheries in California, Ohio, and Michigan. He spent 7 years as a management biologist in Fairbanks, Alaska working with lake trout, Arctic char, northern pike and various whitefish species, before arriving at the Service's Northern Central Valley Fish and Wildlife Office in Red Bluff, California 7 years ago. Currently he is the Deputy Project Leader at this office.

Craig D. Martin.—Mr. Martin is a 1991 graduate from West Virginia University (B.S., wildlife management with fisheries emphasis) and a 1995 graduate from Oklahoma State University (M.S.; fisheries biology). He started his career working in West Virginia and Pennsylvania as a fisheries technician for West Virginia University and West Virginia Department of Natural Resources. While pursuing his Master's degree, he worked for the Oklahoma Cooperative Fish and Wildlife Research Unit evaluating native smallmouth bass stream fisheries. Mr. Martin has been with the U.S. Fish and Wildlife Service for 3 years and is currently a fisheries biologist with the Service's Red Bluff Office.

VII. Compliance with Standard Terms and Conditions

We will provide the appropriate documents and signatures regarding Submittal/Compliance of Standard Terms and Conditions, prior to signing final contracts, as indicated in the Table D-1 matrix of Standard Clauses/Proposal Request for a public agency proposing a Group 3 (Services) application type.